

# **CHAPTER 1**

## **INTRODUCTION**

## **1.1 General**

The Sanitary Sewer and Pumping Station Manual is one of seven manuals developed by the Lexington-Fayette Urban County Government (LFUCG) for the design and construction of infrastructure. The specific subjects of these manuals are:

- Procedures Manual for Infrastructure Development
- Stormwater
- Roadway
- Sanitary Sewer and Pumping Station
- Structures
- Geotechnical
- Construction Inspection

## **1.2 Purpose**

The purpose of this manual is to provide information regarding design and construction requirements for sanitary sewers, pumping stations, and force mains in Fayette County. The goal is to provide uniform design and construction standards. The end result will be public infrastructure that is cost effective and maintainable by the LFUCG in the long term.

### **1.3 Structure of the Manual**

The manual is composed of the following sections:

#### **Section 2 - Drawing Requirements**

Outlines the requirements for plans submitted to the LFUCG for sanitary sewers, pumping stations, and force mains.

#### **Section 3 - Construction Procedures**

Defines roles and responsibilities during the construction process and lists the construction inspection testing required.

#### **Section 4 - Flow Determination**

Provides the information necessary to calculate flows for sanitary sewers, pump stations, and force mains.

#### **Section 5 - Computer Modeling**

Discusses the status of computer modeling.

#### **Section 6 - Sanitary Sewers**

Provides the information necessary to properly design sanitary sewers and defines the requirements for utility easements.

#### **Section 7 - Pumping Stations**

Defines the classes of pumping stations and their requirements and the hydraulic design criteria to design pumping stations and force mains.

## 1.4 Definitions

**AASHTO** - An abbreviation for American Association of State Highway and Transportation Officials.

**AWWA** - An abbreviation for American Water Works Association.

**Air Release Valve** - Valve installed at high points to allow gases to escape.

**ASTM** - An abbreviation for American Society for Testing and Materials.

**Backfill** - The refilling of an excavation after a structure has been placed therein or the material placed in an excavation in the process of backfilling. In sewer construction, backfill refers to the material placed in the trench from the top of the pipe encasement or cap up to the ground or subgrade level.

**Builder** - The person(s) or firm who constructs a residential house, apartment, or commercial building(s) on part or all of a development.

**Carrier Pipe** - Sanitary or storm sewer piping slipped inside the installed casing pipe.

**Casing Pipe** - Steel pipe with continuous circumferential butt-welded joints, jacked into position during the boring operation.

**Castings** - Metallic objects (normally cast iron) formed of molten metal in a mold. Examples are manhole lids, manhole rims, catch basin grates, and frames, etc.

**Check Valve** - Valve that prevents fluid, such as sewage, from flowing backwards.

**Cleanout** - An upturned sewer pipe, generally placed at the end of the sewer, for providing means for inserting cleaning tools, for flushing, or for inserting an inspection light into the sewer.

**Clearing** - The cutting and removal of all trees, logs, and brush to about 1 foot above the ground surface.

**Compaction** - The act of compressing a given volume of material into a smaller volume by rolling, tamping, or wetting. In earthwork construction, subgrade preparation, and in paving, compaction is needed to increase the density, strength, and stability of the soil or bituminous concrete and decrease its permeability.

**Construction Inspector** - The individual who will provide the day-to-day, full-time inspection of a project under the direction of the Engineer.

**Contractor** - The person(s) or firm hired by the Developer or LFUCG to construct the infrastructure.

**Control Panel** - A panel with electrical controls for pump operations that generally includes an electrical pump operations display.

**Cradle** - Refers to bedding and haunching materials being laid upward from the trench bottom to the springline of the pipe.

**Developer** - The person(s) or firm that owns the land which is being developed and who is responsible for the construction of the infrastructure.

**Development** - The land which is being converted to a particular use and for which the infrastructure is being constructed.

**DI** - An abbreviation for Ductile Iron (piping).

**Duplex** - A pumping station containing two pumps.

**Encasement** - Class A concrete used to enclose a sewer in a trench. Encasement shall extend at least 6 inches all the way around the outside of the exterior wall of the pipe being encased.

**Enclosure** - The cabinet or specially designed box in which electrical controls and apparatus are housed. It is required to protect persons from live electrical parts and limit access to authorized personnel. It also provides mechanical and environmental protection.

**Engineer** - The engineering firm responsible for the design of the sanitary sewer, pumping station, and force main.

**Exfiltration** - The exit of sewage through faulty joints or cracks in pipes or manholes.

**Force Main** - A pipe under internal pressure created by being on the discharge side of a pumping station.

**Gate Valve** - Manual, screw-type, pipe valves within the discharge piping that isolate one or both of the discharge pipes from the force main during maintenance.

**GPM** (gpm) - An abbreviation for gallons per minute.

**Grout** - A fluid mixture of cement, sand, and water that can be poured or pumped easily.

**Guide Rails** - Steel tracks that align the boring equipment to the correct pipe direction and grade within the boring pit. Also includes the steel rails that align the submersible pumps to the discharge pipes.

**Guide Rail System** - A device that allows the submersible pump-motor unit to be installed in or removed from the wet well, without disconnecting any piping and without anyone having to enter the wet well.

**Grubbing** - The removal of all stumps and roots after the clearing operation.

**Haunches** - Pipe exterior below the springline to the outside bottom where crushed stone shall be hand placed and consolidated to provide uniform side and bottom support.

**HDPE** - An abbreviation for High Density Polyethylene (piping).

**Home** - Refers to condition that occurs when spigot or tongue end of pipe has been properly inserted into the bell or groove end. On PVC pipes, a reference mark is provided on the spigot end to indicate when the section of pipe has been pushed “home.”

**Infiltration** - The entrance of groundwater into a sewer system through faulty joints or cracks in the pipes or manholes.

**Invert** - The lower portion of a sewer or structure; the portion that is below the springline and is concave upward. Also, the lowest point on the inside surface of a sewer is referred to as the invert, particularly in reference to the elevation or slope of the sewer.

**Lag Pump** - A succeeding or backup pump in a pump system. Control systems usually alternate pump operations between the lead and lag pumps.

**Lateral** - Sewer line from a residential unit to the collector sewer, consisting of two (2) components, the house lateral from the residential unit to the easement and/or R/W, and the sewer lateral from the easement and/or R/W to the collector sewer.

**Lead Pump** - The first pump to start in a pump cycle.

**LFUCG** - An abbreviation for the Lexington-Fayette Urban County Government.

**Mandrel** - A device used to check installed flexible pipe for excessive deflection (greater than 5%). A mandrel is specifically sized for the diameter of pipe to be tested. As the mandrel is pulled through the pipe, excessive deflection in the pipe will prevent its passage.

**Manhole** - A sewer appurtenance installed to provide: 1) access to sewers for inspection and maintenance; and 2) for changes in sewer direction, elevation, and grade.

**Markers** - Concrete or steel posts that identify force main alignments. Also includes metallic tape.

**Maximum Dry Density** - The maximum density obtained in a Proctor moisture-density test using a specific compactive effort and method of compaction specified by ASTM D 698 or ASTM D 1557.

**Mercury Float Switches** - Electrical mercury switches mounted in watertight, polyurethane-coated, steel shell, tilt bulbs suspended from the top slab of the wet well/pit that start/stop the pumps. Usually four switches control the pump operations.

**Non-Submersible Pumps** - Wastewater pumps used in dry pump chambers designed to operate in open air.

**Optimum Moisture Content** - The moisture content corresponding to the maximum dry density in a Proctor moisture-density test.

**PVC** - An abbreviation for Polyvinyl Chloride (piping).

**Percent Compaction** - The ratio, expressed as a percentage of: 1) dry unit weight of a soil as established in a job site embankment or backfill; 2) maximum unit weight obtained in a laboratory compaction test.

**Plumber** - The person(s) or firm that subcontracts with a builder to install the plumbing system in a building or house, including the lateral.

**Precast** - That which is formed in a mold or formed and distributed by the manufacturer as a complete unit.

**Proctor Test** - A laboratory compacting procedure whereby a soil at a known water content is placed in a specified manner into a mold of given dimensions, subjected to a compactive effort of controlled magnitude, and the resulting unit weight determined. The procedure is repeated for various water contents sufficient to establish a relation between water content and unit weight.

**RCP** - An abbreviation for Reinforced Concrete Pipe.

**Record Drawings** - Engineering plans that have been revised to reflect all changes to the plans that occurred during construction.

**RPM** - An abbreviation for Revolutions per Minute

**Sanitary Sewer** - A sewer that carries liquid and waterborne wastes from residences, commercial buildings, industrial plants, and institutions, together with minor quantities of ground, storm, and surface waters that are not admitted intentionally.

**SDR** - Abbreviation for the Standard Dimension Ratio expressed as the outside diameter of the pipe divided by the pipe wall thickness.

**Sealing Flange** - The connection between the pump discharge and force main when used with guide rail systems.

**Service Pole** - Utility pole providing electrical service, usually equipped with electric meter and telemetry enclosure.

**Sewage** - Largely the water supply of the common community after it has been fouled by various uses.



**Sewer** - A pipe or enclosed channel that carries wastewater or drainage water.

**Slope** - The gradient in feet per foot or expressed as percent.

**Springline** - The line on the outermost points on the side of a sewer. On a circular sewer, it would be the line on the points at half the diameter above the invert.

**Station** - A distance of 100 feet, measured along a centerline or baseline and designated by a stake bearing its number.

**Storm Sewer** - A sewer that carries storm water and surface water, street wash and other wash waters, or drainage, but excludes domestic wastewater and industrial wastes. Also called storm drain.

**Stripping** - The removal of topsoil or other material unsuitable for use in compacted earth fill, beneath foundations, or pavements.

**Structural Fill** - Selected fill material placed, compacted, and inspected according to specific density and moisture requirements.

**Submersible Pumps** - Submersible wastewater pumps are vertical, close-coupled, extra-heavy-duty pump and motor units that are designed to operate beneath the liquid they are pumping. They are non-clogging, usually having a 3-inch or larger discharge, and are also called submersible sewage pumps.

**Support Bracket** - Metal mounts that secure the discharge pipe(s) to the internal wall of the wet well.

**TDH** - An abbreviation for Total Dynamic Head.

**Telemetry** - The transmitting of alarm and control signals from remote pump station controls to a central monitoring location.

**Topsoil** - Soil at or below the ground surface, usually high in organic content and unsuitable for structural fill applications.

**Trench** - Usually a long, narrow, near vertical-sided cut in rock or soil such as is made for utility lines.

**Trench Width** - A specified minimum or maximum horizontal trench dimension which shall be maintained from below the pipe to at least one foot above the top of pipe.

**TV Survey** - Inspection method for PVC sanitary sewers where a video camera and skid assembly is pulled through a pipe section.

**Valve Vault** - Precast or cast-in-place concrete structure housing gate valves, check valves, and air release valves.

**Volute** - The casing of a centrifugal pump made in the form of a spiral or volute as an aid to the partial conversion of the velocity energy into pressure head as the water leaves the impeller.

**Wet Well** - An underground concrete storage tank for the temporary storage of sewer influent and containment of submersible pumps, piping, and float bulb switches.

## 1.5 References

*Design Manual*, Louisville and Jefferson County Metropolitan Sewer District (MSD), Revised Edition, 1995.

*Lexington/Fayette Urban County Sanitary Sewer Pumping Stations; General Requirements for Administration, Design and Construction*, July 1992.

*Recommended Standards for Wastewater Facilities*, Ten States Standards, 1990.

*Design of Wastewater and Stormwater Pumping Stations, Manual of Practice ED-4*, Water Environment Federation, 1993.